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BioRegEU. A pilot dataset for regional employment and value added in the EU bioeconomy

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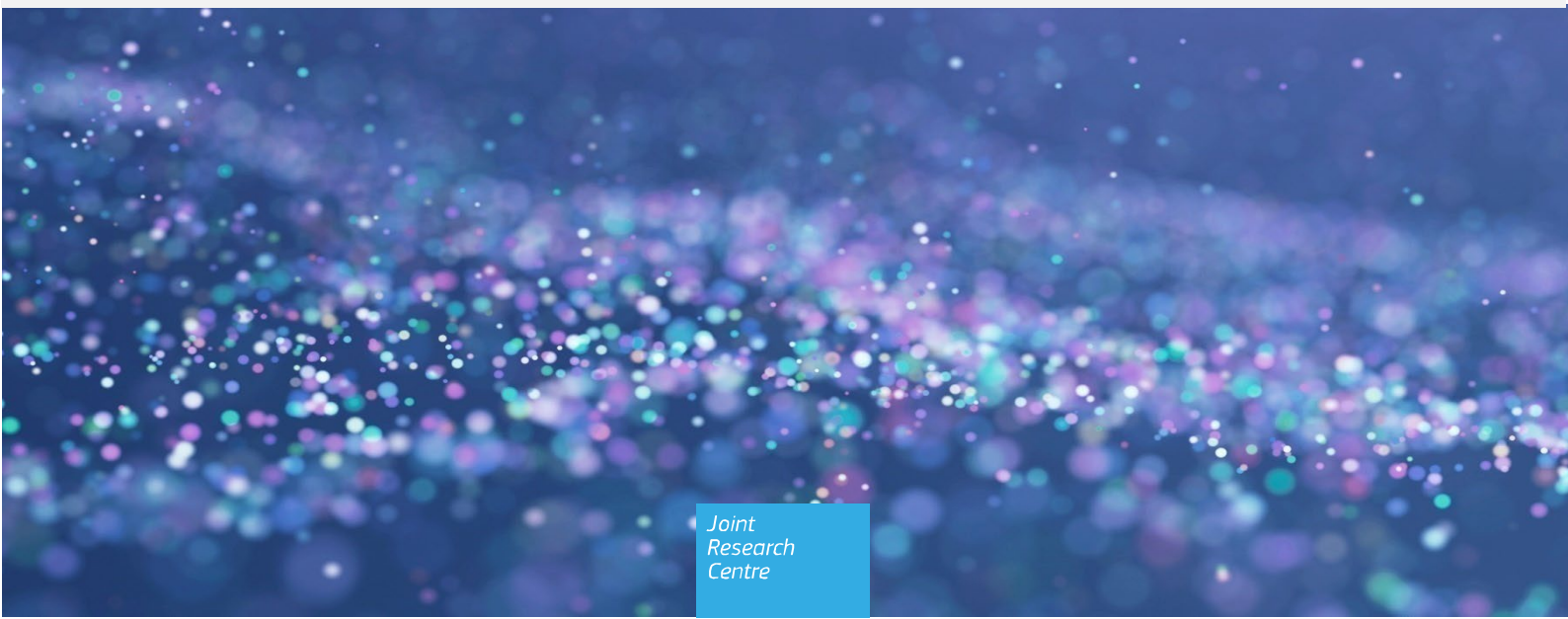

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Contents

Abstract

The analysis of the regional dimension of the bioeconomy is important due to its policy implications. The EU's Bioeconomy Strategy recognizes the potential contribution of the bioeconomy for the development of rural and remote areas. More recently, an increasing number of EU regions are launching their own bioeconomy strategies, and a number of EU initiatives seek to promote the deployment of the bioeconomy to boost rural areas and create jobs and growth opportunities (e.g. the Council of the European Union's Conclusions on the opportunities of the bioeconomy, approved on April 25, 2023, or the Regional Innovation Valleys for the Bioeconomy and the Food system).

Despite the political momentum, data availability on the socioeconomic contributions of the bioeconomy is still very limited, making it challenging to evaluate the outcomes of the aforementioned policies. This document presents the BioRegEU pilot dataset, which aims to fill this data gap by providing estimates of employment and value added in the bioeconomy sectors at the EU NUTS2 level.

Although the analysis of the data offers insights into the territorial distribution of bio-based activities at the EU level, it is still preliminary and requires further refinement. In this sense, the authors of this report invite users and interested parties to provide feedback on the accuracy of the overview drawn by the estimates and identification of potentially significant deviation from reality according to expert knowledge, as well as on potential improvements on data sources of methodologies.

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1 Introduction

The analysis of the regional dimension of the bioeconomy is of special relevance given its policy implications. The fifth objective of the EU's Bioeconomy Strategy recognizes the potential contribution of the bioeconomy for regional development (European Commission, 2018). This territorial approach reveals common objectives and synergies with important other important EU strategies, such as the rural development policies (Common Agriculture Policy or the Long-term Rural Vision, 2040) or the EU Cohesion Policy (Robert et al. 2020). Furthermore, since the update of the EU's Bioeconomy Strategy in 2018, a growing number of EU regions have launched their own strategy for the bioeconomy and/or related relevant fields (Haarich et al, 2022).

In light of the socioeconomic consequences of major recent events (COVID-19 pandemic or the invasion of Ukraine), promoting the EU bioeconomy has become an important topic, given its potential to create shorter and more circular bio-based supply chains, therefore reducing dependence on imported basic resources, and contributing the green transition. This drive towards the bioeconomy has also had its reflection on a regional level. Indeed, some recent EU initiatives aim to promote the bioeconomy as an important axis to create opportunities for regional development. The Council of the European Union's Conclusions on the opportunities of the bioeconomy, approved on April 25, 2023 is one of these initiatives. These conclusions emphasize the potential of the bioeconomy to address challenges such as climate change, fossil fuel dependency, and food security, while boosting rural communities by encouraging innovation, promoting job creation making use of local and/or regional specificities[1]. This objectives are also stressed in a recent Staff Working Document from the European Commission *"Co-creation of a transition pathway for a more resilient, sustainable and digital agri-food ecosystem" (European Commission, 2023).* Last, one of the specific focus of Regional Innovation Valleys is in the bioeconomy, aiming to "support and accelerate the deployment of the bioeconomy in regions where people live and work", while addressing innovation gaps among EU regions([2]).

The political momentum surrounding the EU bioeconomy highlights the need for data availability to assess its performance at the regional level. Beyond shedding light on the territorial distribution of bio-based activities and filling the regional gap in the EU-Bioeconomy Monitoring System, quantifying the contribution of the bioeconomy at this level allows for analysis of important issues such as the role of the bioeconomy on rural development and regional competitiveness or the contribution to regional resilience to economic shocks such as the derived ones from the COVID-19 pandemic or the Russian invasion of Ukraine. However, while there has been extensive development of estimates of the socioeconomic contributions of the bioeconomy at the country level (see e.g Kuosmanen et al., 2020), the regional dimension of this aspect remains a data-poor environment, which makes difficult to analyse the aforementioned issues.

This document presents the BioRegEU pilot dataset, which is intended as a first step toward the objective of filling this gap. TheBioRegEU pilot dataset aims to contribute to the downscaling the socioeconomic analysis of the bioeconomy to the subnational level. The estimates are prepared using a refined version of the methodological approach described in Lasarte-López et al. (2022) to estimate employment and value added in the bioeconomy sectors at the EU NUTS2. This approach consists of a systematic combination of regional statistics from Eurostat (and other data sources) with national bio-based output shares from the publicly available BMS-Jobs&Growth dataset. The approach also proposes criteria to regionalize national statistics when the regional breakdown is not available in Eurostat, as well as a range of algorithms to fill in the missing data and obtain a full dataset.

The users and stakeholders of the BioRegEU pilot dataset should note that the data is still preliminary. Although they could potentially offer relevant insights regarding the general territorial distribution of the bio-based activities at the EU level and, potentially, within countries, they still require further refinement. In this sense, the authors of this report **invite users and interested parties to provide feedback** on the accuracy of the overview drawn by the estimates and identification of potentially significant deviation from reality according to expert knowledge, as well as on potential improvements on data sources of methodologies.

The rest of the document is structured as follows. Section 2 briefly describes the methodological approach and the refinements implemented with regard to Lasarte-López et al. (2022). Section 3 presents the tool created in DataM to visualize the data.

([1]) The Council of the European Union's Conclusions on the opportunities of the bioeconomy, approved on April 25, 2023 can be accessed here

([2]) Information on the Regional Innovation Valleys for Bioeconomy and Food System initiative is available here.

2 Methodology

2.1 Sectoral scope

Table 1 lists the sectors covered by the pilot dataset, according to the Statistical classification of economic activities in the European community (NACE Rev. 2). While primary sectors and manufacturing of food products, beverages and tobacco are considered fully bio-based (only produce biomass), the rest of manufacturing sectors are considered to partially fall within the scope of the bioeconomy, since their production contains part of biomass, but also non bio-based materials. The applied bio-based shares are those proposed by Ronzon et al. (2020), which are publicly available in the BMS-Jobs&Growth. These sectors are manufactures of bio-based products and electricity generated from biomass.

Table 1. Delimitation of the bioeconomy sectors by 2-digit NACE Rev. 2 codes

Industry	Bioeconomy sectors
Agriculture, Forestry and Fishing	A01 - Agriculture A02 - Forestry A03 - Fishing
Manufacturing sectors	C10 - Manufacture of food products C11 - Manufacture of beverages C12 - Manufacture of tobacco products C13-15* - Manufacture of textiles, wearing apparel and leather C16* - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials C17* - Manufacture of paper and paper products C20-22* - Manufacture of bio-based chemicals , pharmaceuticals and rubber and plastics products C31* - Manufacture of furniture
Bio-energies	D35* - Electricity, gas, steam and air conditioning supply (D35.1.1 - Production of electricity)

Note: For sector with codes flagged, only their bio-based activities are considered.

Source: Lasarte-López et al. (2022) and own elaboration.

Given the uncertainty regarding some sectors, some results will be presented in aggregated way. Specifically, C13, C14 and C15 will be aggregated in a broad "Bio-based textiles" category, while C20, C21 and C22 will be also aggregated in "Bio-based chemicals, pharmaceuticals and plastics and rubber".

2.2 Indicator definition

The number of people employed is "the total number of persons who work in the observation unit, as well as persons who work outside the unit who belong to it (…) and are paid by it" (European Commission, 2009).

Value added at factor cost "is the gross income from operating activities after adjusting for operating subsidies and indirect taxes" (European Commission, 2009). It is measured at nominal prices in this study, as in the Eurostat sbs_na_ind_r2 data source.

Both indicators will be computed for the EU NUTS2 territorial unit during the period 2008-2020, and for the sectors listed in Table 1.

2.3 Key aspects of the methodological approach

As shown on Figure 1, the method described in Lasarte-López et al. (2022) proceeds in three stages. Stage 1 consists of the data collection and harmonization process. We employ regional statistics from Eurostat and national estimates from JRC-Bioeconomics (Ronzon et al. 2020) as the main data sources from our dataset. After compiling the available information, we apply some harmonization and consistency check procedures to homogenize the information from all data sources.

Stage 2 deals with the transformation of the regional series in the dataset so as to adjust them to the definition of the EU's Bioeconomy Strategy and the derived sectoral scope indicated in section 3.1. Two main procedures are applied in this stage. First, we make preliminary estimates for those series for which neither Eurostat provides a regional breakdown, nor an alternative national official data source has been found. Second, we quantify the contribution of hybrid sectors to the bioeconomy through the application of bio-based shares.

Stage 3 aims to complete all the missing information that remains in the dataset after stages 1 and 2. For this purpose, we apply some computational algorithms to estimate the missing values, as well as ensuring consistency across the dataset.

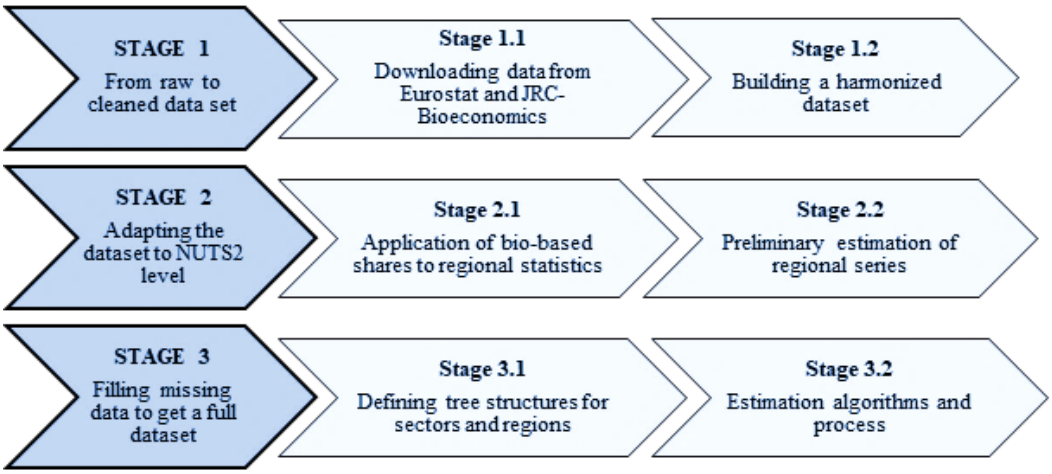

Figure 1. General overview of the methodological approach for the estimation of regional employment and value added in the bioeconomy

Source: Lasarte-López et al. (2022)

A more detailed description of the methodology is provided by Lasarte-López et al. (2022)

2.4 Limitations of the method and refinements

As mentioned, the methodology was published as a technical report in 2022, which also presented some insights on the regional dimension of the EU bioeconomy. However, the report also identified the main limitations of the methodology and discussed some potential lines of action to overcome them. The current version of the dataset incorporates some refinements, based on the aforementioned limitation, so as to improve the accuracy and reliability of the results. Table 2 summarizes the solutions and refinements implemented so far according to the limitations and/or the lines of action identified in the report.

Table 2. Limitations, future line of actions and implemented solutions

Limitations of the approach	Proposed lines of actions	Identified solution	Status
Absence of regional breakdown for A subsectors in Eurostat data sources	Criterion to estimate values for A02 and A03	A02: corrective coefficient based on forest class. **A03:** Using **Natale et al. (2013)'s** method for fisheries employment.	A02: In progress **A03: Implemented**
Application of national bio-based shares to regions	Adjustment of bio-based shares to regional production	Using information on location of bioeconomy clusters or production units.	To be further developed
Regional VA calculated from national VA per worker	More realistic assumption for regional VA	Adjusting regional VA with Wages and Salaries (available at NUTS2 level).	**Implemented**
-	Integrating regional statistics from national data sources.	Including official statistics from national data sources with regional breakdown.	**Partly Implemented**

Source: Own elaboration

The refinements conducted with regard to the previous versions are detailed below:

- While the employment and the value added of this sector were calculated as a residual (A03 = A - A01 - A02), in the most recent version of the method, the method and results from Natale et al. (2013) are employed as a starting point for the fishing sector.
- As for value added, the previous version of the methodology applied the national value added per worker to regional employment by sector to estimate the regional value added in the bioeconomy. In the current version, we apply instead the level of wage and salaries by region (provided in Structural Business Statistics from Eurostat) as a criterion to distribute national value added per sector at the regional level ([3]).
- Finally, an additional line of action was the search and **incorporation of regional statistics from official national data sources**. Table 2 details all the national level data sources that have been identified and incorporated to our dataset.

([3]) In absence of data for value added at the regional level, wages and salaries are used by some authors as a proxy for labour productivity (see e.g. Florida et al., 2011, or Kemeny and Storper, 2014). The use of this criterion is based on the assumption that the level of wages and salaries is reflective of the level of labour productivity, which would allow to identify differences in sectoral productivity by region. While some correlation exists between these variables, we can still identify some limitations for this approach, given that the regional level of wages and salaries are still affected for exogenous factors, such as collective bargaining, the labour market conditions or the existence of national minimum wages (see Koning and Marcolin, 2014 or Kampelmann et al, 2018).

Table 3. Bioeconomy-related regional statistics from MS official data sources

Name	Country	Provider and/or reference	Scope
Economics accounts for Forestry	AT	Statistics Austria	Estimates for gross value added in A02 sector for Austrian NUTS2 regions.
Agriculture, forestry and fishing accounts	IT	ISTAT	Estimates for value added in A01, A02 and A03 for Italian NUTS2 regions.
Regular, irregular employment and population	IT	ISTAT	Estimates for employment in A01, A02 and A03 for Italian NUTS2 regions.
Persons employed of establishments by NUTS - 2013 and Economic activity	PT	INE	Estimates for employment in A01, A02 and A03 for Portuguese NUTS2 regions.
Statistical yearbooks for forestry	PL	Statistics Poland	Official figures for employment in A01, A02 and A03 for Polish NUTS2 regions.

Source: Own elaboration

3 Web interface to access the pilot dataset “BioRegEU”

The web interface consists of four main dashboards that allow for the visualization and analysis of data from different perspectives.

(1) European overview: This page is dedicated to provide a general view of territorial distribution of the bioeconomy across EU NUTS territorial units.

(2) Sectoral composition: This page is designed to compare the sectoral composition of the bioeconomy within each region.

(3) Country view: This page allows focusing on a country and analysing the territorial distribution of bio-based activities within it.

(4) Regional profile: This page allows exploring and visualize data for one specific region.

3.1 “European overview” sheet

The first page of the web interface, called "European Overview," provides key performance indicators (KPIs) and two visualizations: (1) a map representing the share of employment and value added in the bioeconomy for each region, and (2) a stacked column chart that breaks down the contribution share of the bioeconomy across its different sectors.

Both employment and value added can be selected for visualization. Additionally, there are specific filters available to choose countries, regions, sectors, and specific years to be displayed. A screenshot of this page is shown in Figure 2.

3.2 “Sectoral composition” sheet

The “Sectoral composition” sheet allows for a general comparison of the size and structure of bioeconomy sectors across different regions. This sheet includes the following graphs:

(1) Maps showing the absolute contribution of employment and value added in the bioeconomy for NUTS2 regions.

(2) Then the percentage contribution of the selected sector(s) to the total Bioeconomy is informed by two bar charts in terms of employment (left side) and value added or turnover (right side).

(3) It is complemented by two other bar charts showing their contribution in absolute terms. These charts permit to point to big players for examples (the longer bars).

In this page, the selectors allow filtering by sector, country, indicator and year. A screenshot of this page is provided in Figure 3.

3.3 “Country view” sheet

The “Country view” page allows for a more detailed analysis at the country level. The first visualization is a country map with region-specific pie charts showing the sectoral composition of the bioeconomy at the regional level. The initial sectoral breakdown distinguishes between three main branches of economic activities in the bioeconomy: (1) Agriculture, forestry, and fishing; (2) bio-based manufacturing; and (3) bioelectricity. This breakdown provides an approximate idea of the territorial distribution of these activities and the relative specialization by region. However, the visualization also allows selecting a specific category, enabling the pie charts to display the sectoral breakdown within that particular category. The filter by year and variable options are also available.

The second visualization is a time series chart that shows the evolution of the relative contribution of the bioeconomy by region. Depending on the selection, the graph will display the share of employment in the bioeconomy compared to the total employment of the region, or the share of value added to the GDP. The graph is useful for analysing variations in the significance of the bioeconomy across different regions and for identifying divergent trends. This visualization also allows for the selection of a specific sector within the bioeconomy, as well as a specific group of regions. Figure 4 shows an screenshot of this page.

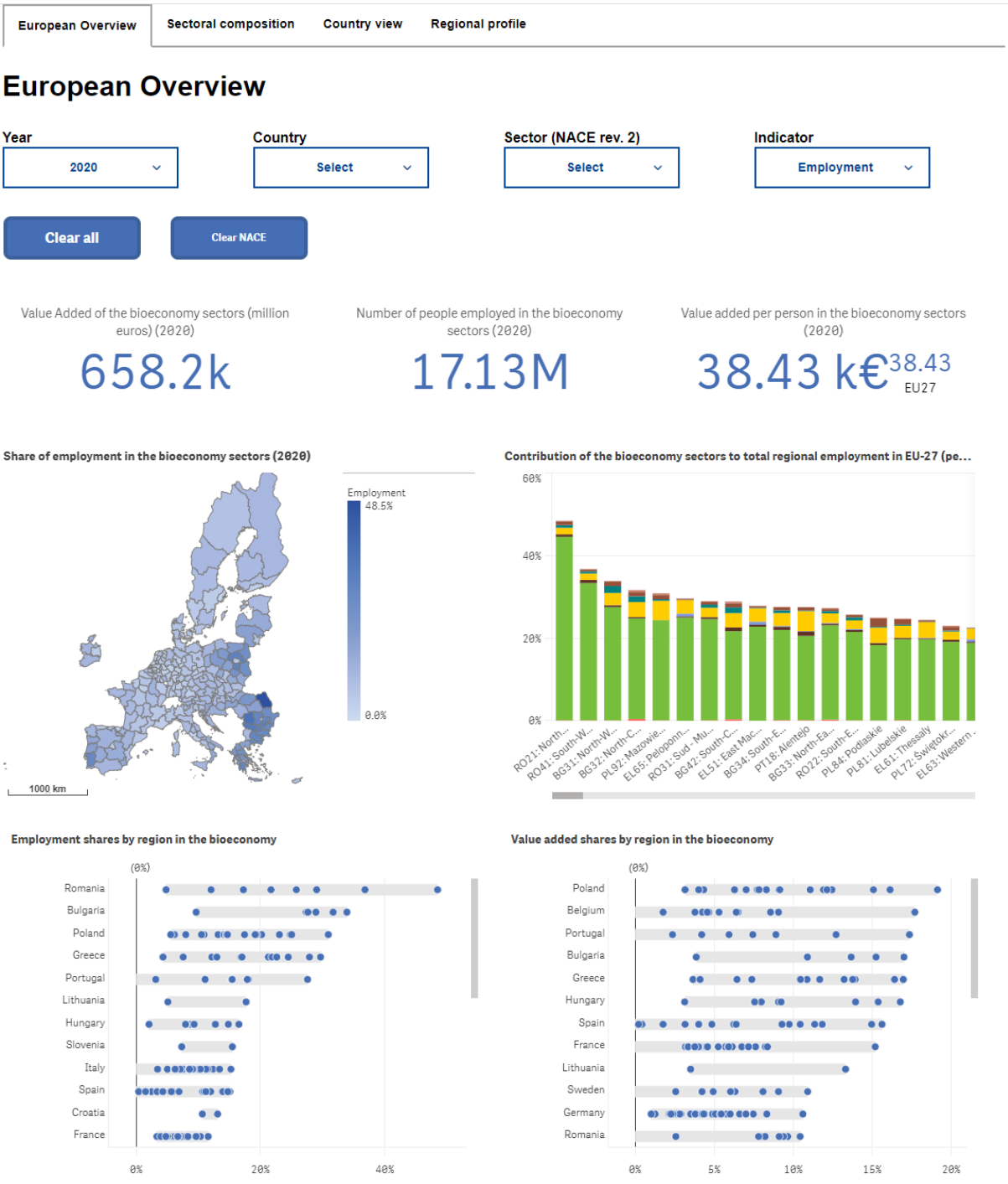

Figure 2. Screenshot of the "European overview" sheet

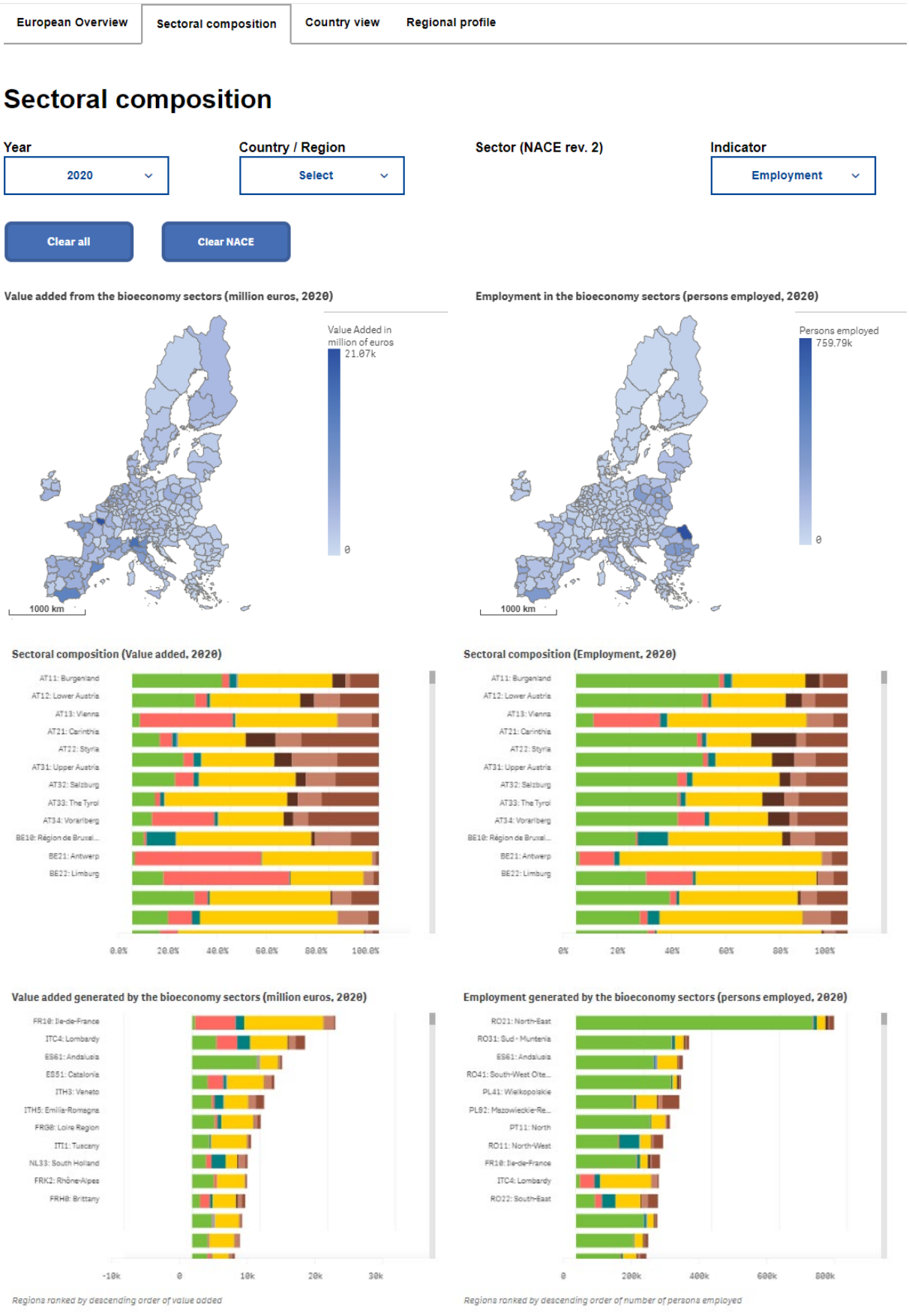

Figure 3. Screenshot of the "Sectoral composition" sheet

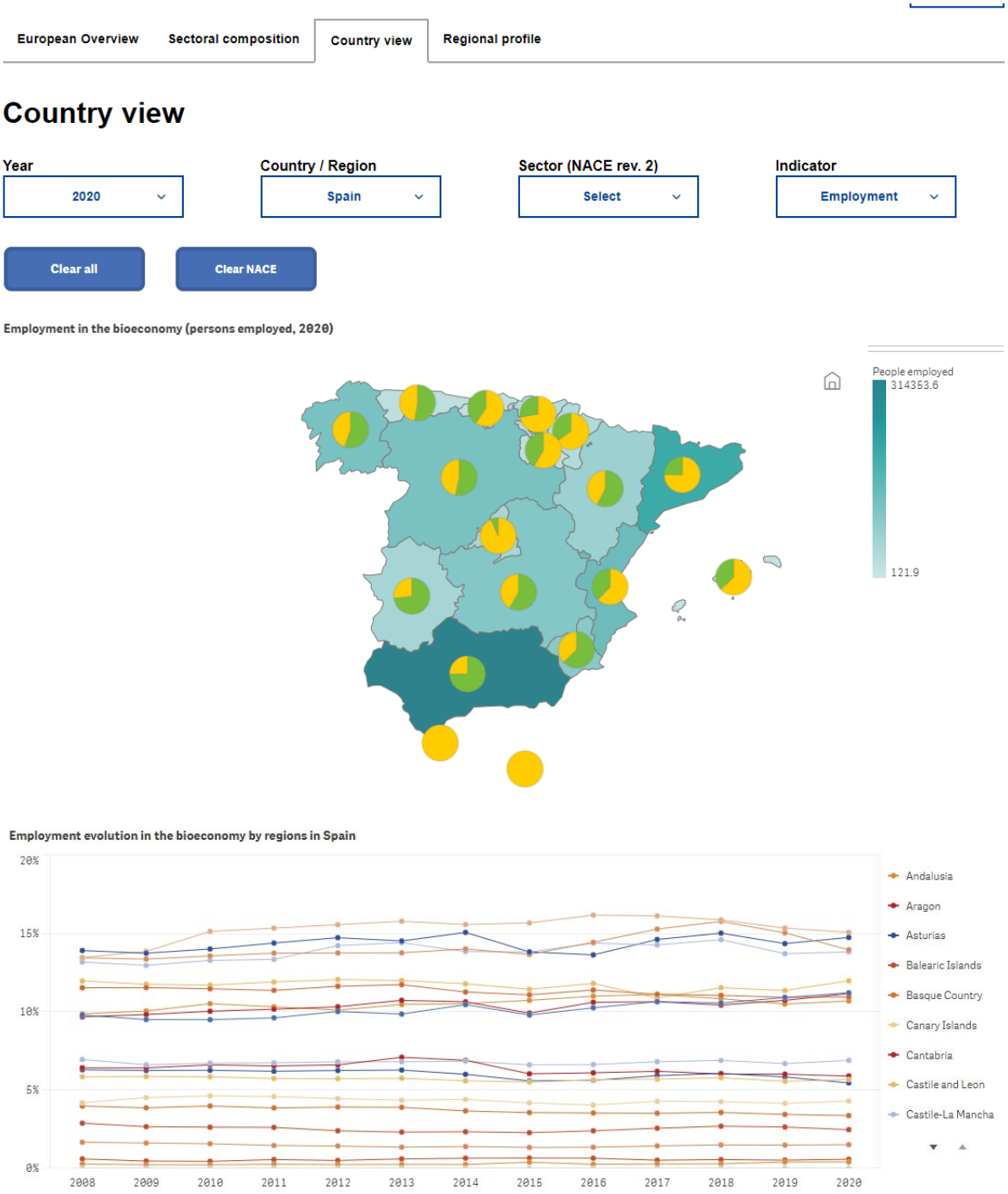

Figure 4. Screenshot of the "Country view" sheet

3.4 “Regional profile” sheet

The last page, "regional profile," allows for focused analysis on a specific region. This page requires selecting a particular region to display the relative structure of the region's bioeconomy compared to the country in a radar chart ([4]). Below, there is a chart of cumulative growth by sector between two specific years in the selected region. At the bottom, time series graphs depict the evolution of employment or value added (depending on the selection) in both absolute and relative terms, with sectoral breakdowns. Figure 5 shows a screenshot of this page.

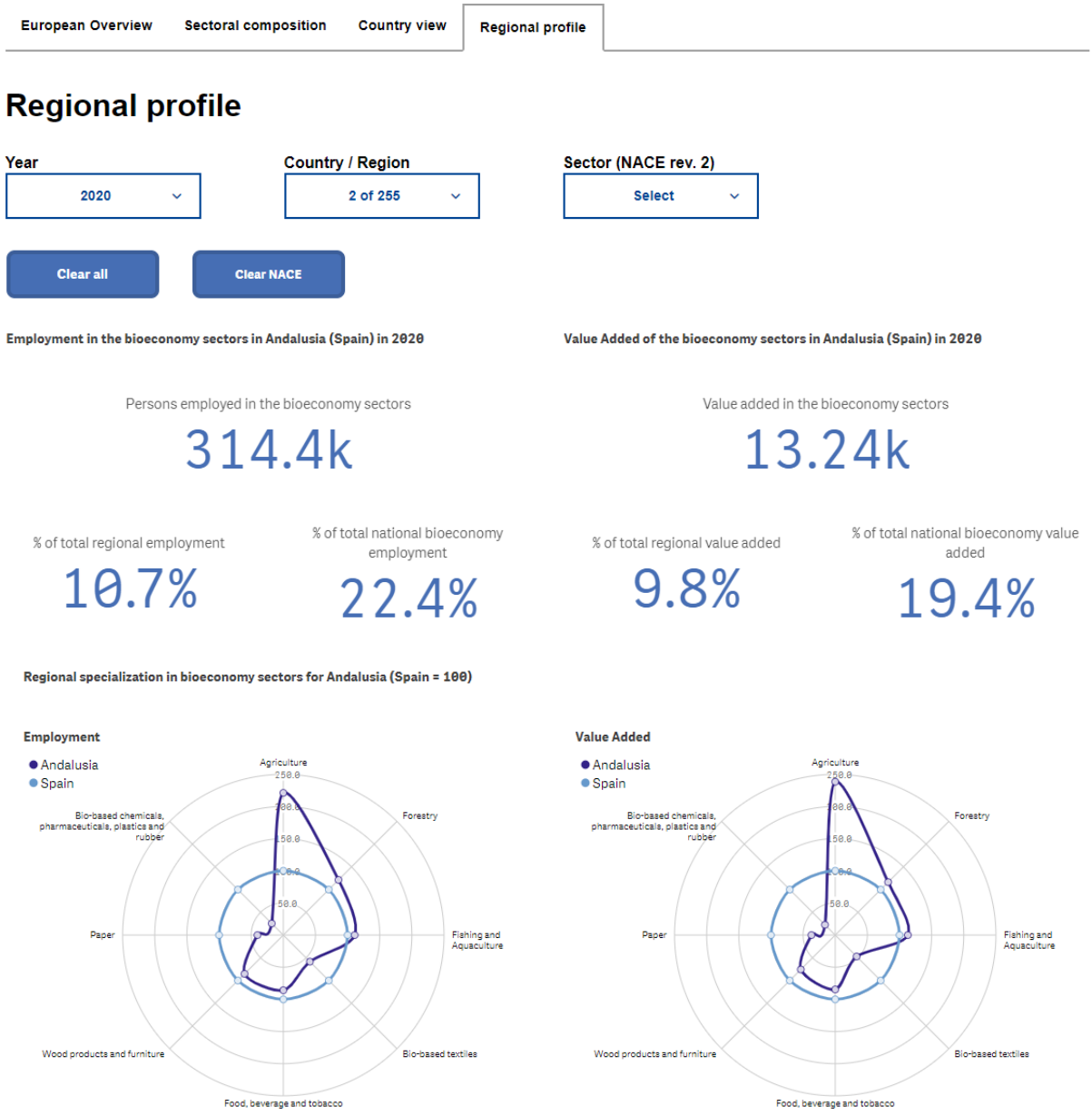

Figure 5. Screenshot of the "Regional profile" sheet (part 1)

([4]) The weight of the bioeconomy in the corresponding country is assigned a value of 1. The relative value of the region is calculated as the ratio between the contribution of the bioeconomy sector to the region's total (in terms of employment or value added) and the national share.

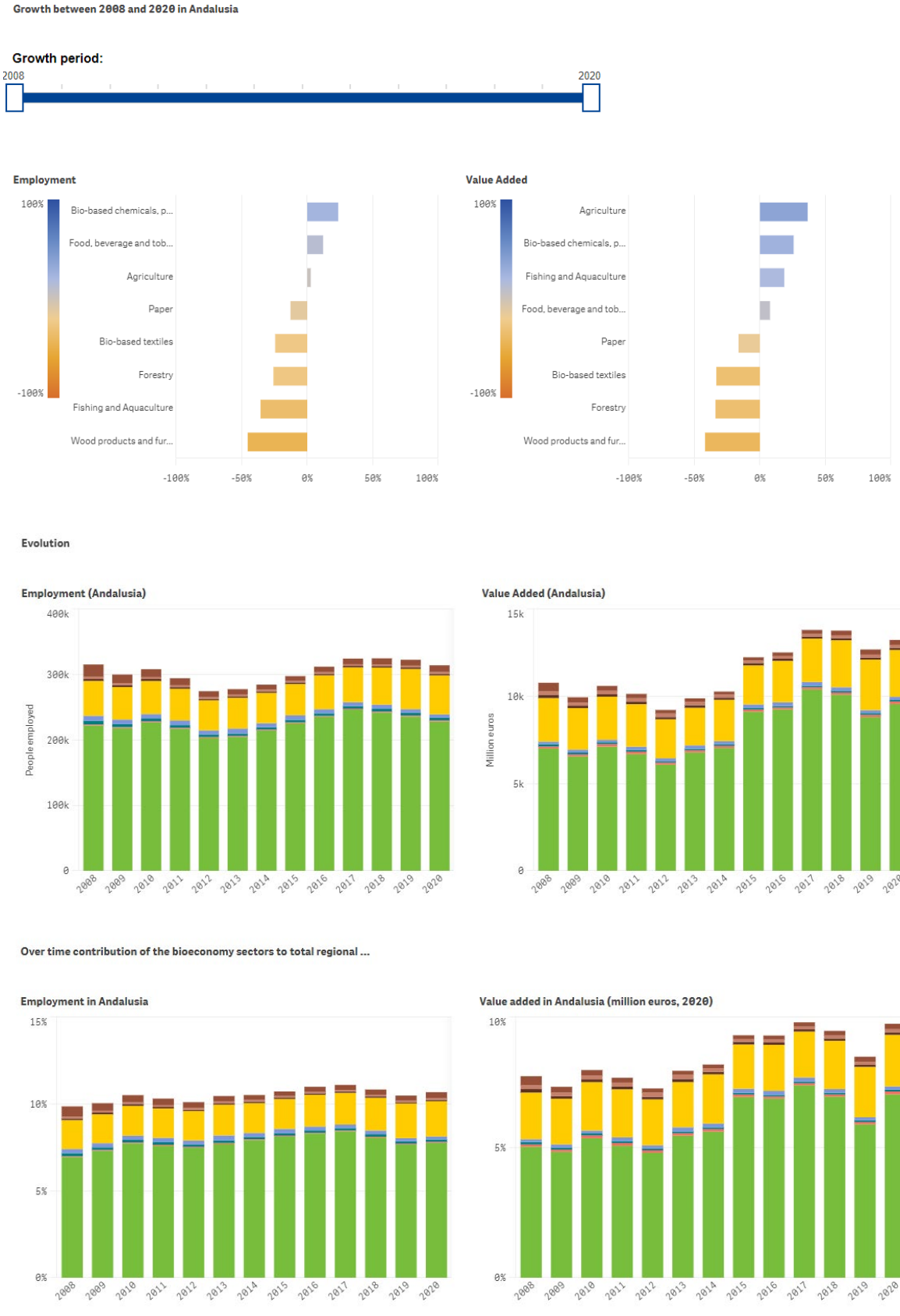

Figure 5. Screenshot of the "Regional profile" sheet (part 2)

4 Conclusions

The political momentum for the deployment of the bioeconomy, and the relevance of different EU policies and initiatives on the territorial dimension, increases the necessity to analyse the bioeconomy at regional level. This document presents the BioRegEU pilot dataset, which aims to provide estimations of employment and value added in the bioeconomy sectors for EU NUTS2 regions. This dataset is prepared using a refined version of the Lasarte-López et al. (2022) methodology, which includes improvements in the regional disaggregation of primary sectors, adjustments in the calculation of value added by sector, and integration of national-level data sources.

The dedicated web interface presents four main dashboards for visualizing and analysing data from different perspectives. The "European overview" dashboard provides a general view of the territorial distribution of the bioeconomy across NUTS2 regions. The "Sectoral composition" dashboard allows for comparing the sectoral composition of the bioeconomy within each region. The "Country view" dashboard allows for focusing on a specific country and analysing the territorial distribution of bio-based activities within it. Lastly, the "Regional profile" dashboard allows for accessing and visualizing data for each region.

It is worth noting that while the analysis of the data provides valuable insights into the territorial distribution of bio-based activities at the EU level, it is still in the preliminary stages and requires further refinement. The authors of this report encourage **users and interested parties to provide feedback** regarding the accuracy of the overview presented by the estimates and to identify any potentially significant deviations from reality based on expert knowledge. Additionally, suggestions for improvements on data sources and methodologies are also welcomed.

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